3.23   Clutter Rejection MTI Functional Element Sensitivity

The purpose of the moving target indicator (MTI) is to differentiate moving targets from clutter reflections by objects on the ground, or by slow-moving objects in the air. MTI is essentially a filtering function which attenuates the returns from stationary or slow-moving targets.

RADGUNS employs separate subroutines MTIACQ and MTIRNG to calculate the MTI attenuation factor for the acquisition and tracking radars. These routines model an MTI canceler circuit that reduces the voltage of a signal as a function of the Doppler frequency due to the targetõs radial velocity. This circuit attenuates signals with no Doppler shift (DC), and also those with Doppler frequencies equal to the pulse repetition frequency or multiples thereof. These blind speeds are eliminated (pushed out of the range of interest) by summing the responses of several staggered PRFs.

Data Items Required

Data Item		Accuracy	Sample Rate	Comments
6.2.1.1	Doppler frequency	± 1 Hz	10 Hz	
6.2.1.2	Target echo	± 0.5 dB	10 Hz	Limit to 10 s intervals
6.2.1.3	Clutter power	± 0.5 dB	10 Hz	Limit to 10 s intervals

3.23.1 Objectives and Procedures

The MTI filter response is sensitive to changes in target radial velocity. *RADGUNS* was exercised using MTI response algorithms to determine the sensitivity of MTI response with respect to changes in radial velocity for the frequency bandwidth of RAD1. Figure 3.23-1 shows the MTI attenuation factor and target detection range for a wide variation in target radial velocities.
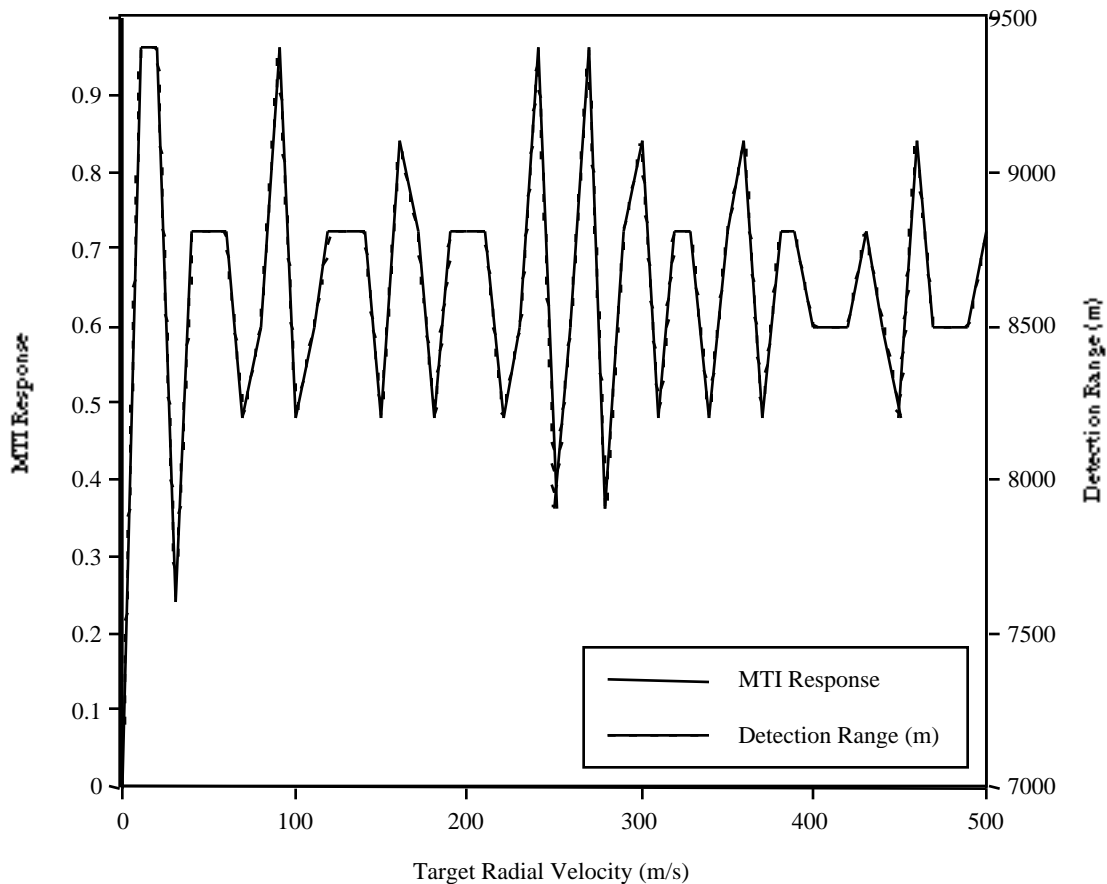
Figure 3.23-1. MTI Response and Target Detection Range as a Function of Target Radial Velocity.

3.23.2 Results

The MTI function is constructed by summing sine-squared functions. This produces peaks and valleys in the filter output as displayed in Figure 3.23-1. An increase in the number of sine-squared functions summed causes an increase in the number of peaks and valleys but a decrease in the amplitude difference between them. The target detection range closely follows the MTI response. Signals with no or very low target radial velocities are significantly attenuated.

3.23.3 Conclusions

Target velocities up to 500 m/s yield MTI attenuation factor values ofof 0.742±0.095 (moderate sensitivity) and detection range values of 8650±412 m (low sensitivity).   As seen in Figure 3.23-1, the MTI filter attenuates all target radial velocities, not just those of non-moving targets. This anomaly has been documented in a Model Deficiency Report.